NOAA's Hydrographic Surveys

Metadata also available as

Metadata:

Identification_Information:
Citation:
Citation_Information:
Originator:
Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Coast Survey (OCS), Hydrographic Surveys Division (HSD)
Publication_Date: 2002
Title: NOAA's Hydrographic Surveys
Geospatial_Data_Presentation_Form: remote-sensing image
Series_Information:
Series_Name: National Ocean Service Hydrographic Survey Database
Issue_Identification: CD-ROM series supplemented by web-based update
Publication_Information:
Publication_Place: Silver Spring, MD
Publisher: NOAA's Ocean Service, Office of Coast Survey
Online_Linkage: <http://chartmaker.ncd.noaa.gov/hsd/hsd-2.html>
Description:
Abstract:
The statutory mandate of the National Oceanic and Atmospheric Administration (NOAA) authorizes NOAA to provide nautical charts and related hydrographic information for the safe navigation of maritime commerce as well as provide basic data for engineering, scientific and other commercial and industrial activities. Data collection and compilation for nautical charts are the principle objectives of a hydrographic survey. Hydrographic survey data support a variety of maritime functions including port and harbor maintenance, coastal engineering, coastal zone management, and offshore resource development. The primary data associated with all hydrographic surveys is water depth; however , there is also considerable interest in sea-floor composition due to its implications for anchoring, dredging, marine construction, and essential fisheries habitat.

Primary depth measurements are made with multibeam echosounder sonar, or with a single beam echosounder if multibeam systems are not available. Multibeam technology obtains hundreds more soundings per unit time than single beam systems and covers a wide swath of the ocean floor. Some surveys employ sidescan sonar

systems, which use a towed instrument to assist in detecting objects (wrecks, rocks, or other obstructions) that project from the sea floor. As potential hazards to navigation, these objects must be fully investigated by multibeam sonar or divers. Sidescan and multibeam sonar are modern systems which provide "100% bottom coverage" of the sea floor, greatly enhancing the ability to detect hazards undiscovered by earlier surveys. Data acquisition produces millions of measurements, which need to be verified and compiled to produce an accurate, understandable graphic depiction of the survey area.

The principle objective of hydrographic surveys is to obtain basic data for the compilation of nautical charts with emphasis on features that may effect safe navigation. Presently there are over 10,000 hydrographic surveys archived by the Office of Coast Survey (OCS). Of this total, approximately 6,000 surveys are in digital format.

Purpose:

he primary purpose of high-resolution multibeam bathymetry is to support safe navigation. However, it can also be valuable to a variety of other users including the coastal stewardship community, geologists, mathematical modelers and habitat researchers. This data may be used on Geographic Information System (GIS). Utilizing their own data, GIS users will be able to overlay the coastal map layer to create new views of their data necessary for advanced analysis and presentation.

NOAA's Hydrographic Surveys Division (HSD) coordinates the acquisition and processing of precisely located geographic data in the marine environment. Hydrographic surveys determine the configuration of the bottoms of water bodies, especially as it pertains to navigation. This information is essential to the production of nautical charts, and also benefits the fishing industry and coastal zone managers. HSD conducts this work to support NOAA's strategic goal of promoting safe navigation.

Supplemental_Information:

To meet its charting mandate, NOAA maintains a suite of approximately 1,000 nautical charts. Many areas portrayed on nautical charts have never been adequately surveyed. Nearly half of the depths published on current charts were measured using lead line techniques before 1940. Additionally, spacing between sounding lines can exceed 100 meters which may result in a failure to identify all navigational hazards in a survey area.

Historical surveys are generally inadequate for modern nautical charts for a variety of reasons. Pre-1940 surveys were done with lead lines that only gave spot soundings of the sea floor. Even surveys done after 1940 but prior to the late 1990's left vast areas of the seafloor unsurveyed as continuous sounding lines with recording echo-sounders were usually 100 meters or more apart. Such widely spaced survey lines may not identify rocks and obstructions which could be hazardous to navigation. In addition, many areas have highly variable water depths due to shifting sand bars caused by wave action or longer term sedimentation from rivers and longshore currents. Lastly, historical sounding positions are less accurate than positioning available to modern vessels using the Global Positioning System (GPS) and electronic navigation chart (ENC) systems. Navigators may not fully understand these accuracy limitations of data from older surveys and may place their vessels at risk due

to overconfidence in the survey data.

In 1994 NOAA began to prioritize survey needs to maximize the efficiency of the limited resources available to conduct hydrographic surveys. The 3.4 million square nautical miles of the Exclusive Economic Zone (EEZ) were examined for navigational significance, giving highest priority to those nearshore areas with the greatest threat of natural and manmade hazards to marine navigation. Approximately 43,000 square nautical miles were identified as critical survey areas which are waterways with high commercial traffic volumes, extensive petroleum or hazardous material transport, and/or transiting vessels with low underkeel clearance over the seafloor. Since the inception of the concept of critical areas in 1994, the NOAA hydrographic fleet and private contractors have reduced the critical survey backlog by almost 15,000 square nautical miles. In addition, in 2000 a more extensive analysis was completed which identified nearly 500,000 additional square nautical miles of the U.S. EEZ as being navigationally significant and in need of new modern surveys.

Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 1834
Ending_Date: present
Currentness_Reference: publication date
Status:
Progress: In work
Maintenance_and_Update_Frequency: As needed
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: +175.0
East_Bounding_Coordinate: -64.0
North_Bounding_Coordinate: +71.0
South_Bounding_Coordinate: +17.0
Keywords:
Theme:
Theme_Keyword_Thesaurus: None
Theme_Keyword: coast
Theme_Keyword: morphology
Theme_Keyword: navigation surveys
Theme_Keyword: seafloor surveys
Theme_Keyword: bathymetry
Theme_Keyword: water depth
Theme_Keyword: hydrographic data
Theme_Keyword: oceans
Place:
Place_Keyword_Thesaurus: None
Place_Keyword: United States
Place_Keyword: Atlantic Ocean
Place_Keyword: Pacific Ocean
Place_Keyword: coast
Place_Keyword: U.S. Exclusive Economic Zone
Access_Constraints: None
Use_Constraints:

These data are not for navigational purposes. These data have been used by the National Oceanic and Atmospheric Administration (NOAA). There is no warranty expressed or implied as to the accuracy of the data made by NOAA. NOAA assumes no liability for uses of these data. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by NOAA in the use of this data, software, or related materials.

Point_of_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization:

National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Coast Survey (OCS), Hydrographic Surveys Division (HSD)

Contact_Position: Chief, Hydrographic Surveys Division

Contact_Address:

Address_Type: mailing and physical

Address: 1315 East West Highway N/CS3

City: Silver Spring

State_or_Province: MD

Postal_Code: 20910

Contact_Voice_Telephone: 301-713-2700

Contact_Electronic_Mail_Address: HSD.Inquiries@noaa.gov

Native_Data_Set_Environment:

Microsoft Windows 2000 Version 5.0 (Build 2195) Service Pack 3; ESRI ArcCatalog 8.2.0.700

Data_Quality_Information:

Logical_Consistency_Report:

The minimum standards for Multibeam echosounder sonar system resolution are set forth in the NOS Hydrographic Surveys Specifications and Deliverables. The hydrographer of a given survey must maintain and operate the Multibeam sonar system from data acquisition to processing, such that it detects shoals that measure 2 m x 2 m horizontally and 1 meter vertically in depths of 40 meters or less. For depths greater than 40 meters, the minimum size of detectable targets shall be 10 percent of the depth horizontal dimension and 5 percent of the depth for vertical dimensions. Depths are determined and recorded with a vertical resolution no coarser than 10 centimeters.

To meet the accuracy and resolution standards as defined in the NOS Hydrographic Surveys Specifications and Deliverables, observed echosounder depths are corrected for all departures from the true depths attributable to the method of sounding or to faults in the measuring apparatus.

Completeness_Report:

Many areas portrayed on nautical charts have never been adequately surveyed. Nearly half of the depths published on current charts were measured using lead line techniques before 1940. Additionally, sounding distributions can exceed 500 meters and may not represent significant water depths. Navigators may not understand these and other accuracy limitations of data from older surveys and may place their vessels at risk. The production of high-quality charts depends on the availability of up-to-date, reliable hydrographic survey data.

Prioritizing survey areas to maximize the efficiency of the limited resources available for conducting hydrographic surveys is essential. To accomplish this, the 3.4 million square miles of the U.S. Exclusive Economic Zone (EZZ) were examined for navigational significance, of this region approximately 500,000 square nautical miles of the EZZ were deemed navigationally significant.

The navigationally significant survey backlog is being currently worked through with emphasis placed on certain regions that are of critical navigational concern.

Standard field surveying and processing procedures are followed in producing each hydrographic survey in accordance with the NOS Hydrographic Surveys, Specifications and Deliverables (June 2000). Each survey is complete and adequate for charting purposes

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report:

The NOS specification for hydrographic positioning is that the total error in position of soundings, dangers, and all other significant features, at the 95 percent confidence level, will not exceed +/- 5 meters.

The following specifications were followed when Differential Global Positioning System (DGPS) was used as the primary positioning system.

GPS receiver(s) aboard the vessel were configured such that satellites below 8E above the horizon were not used in position computation.

Horizontal Dilution of Precision (HDOP) was monitored and recorded, and did not exceed 2.5 nominally. Satellite geometry alone is not a sufficient statistic for determining horizontal positioning accuracy.

A minimum of four satellites were used to compute all positions.

Horizontal and vertical offsets between the GPS antenna and transducer(s) were observed and applied in no coarser than 0.1. m increments.

DPGS Site Confirmation

A 24-hour certification of all non-USCG differential reference stations prior to use for positioning control was conducted. The purpose of this certification was to ensure that no multipath or other site specific problems existed. Certification for any non-USCG differential station is valid for one year only.

Quantitative_Horizontal_Positional_Accuracy_Assessment:

Horizontal_Positional_Accuracy_Value: 5

Horizontal_Positional_Accuracy_Explanation:

Numerous data quality control measures are in effect to make sure horizontal positional errors did not exceed 5 meters; independent of survey scale.

Vertical_Positional_Accuracy:

Vertical_Positional_Accuracy_Report:

NOS standards for the accuracy of measured depths in hydrographic surveys apply to the systematic measurement of general water depths and to the least depths determined over wrecks and obstructions. By extension, they also apply to the elevations of rocks or other features which uncover at low water and to the measurement of overhead clearances. These standards apply regardless of the method of determination; whether by single beam echosounder, Multibeam echosounder, lead line or diver investigation.

The total sounding error in a measured depth at the 95 percent confidence level, after systematic and system specific errors have been removed, shall not exceed

+/- = sqrt((a*a+(b*d)*(b*d)) with a = 0.5, b = 0.013, d = depth in meters

The maximum allowable error in measured depth includes all inaccuracies due to residual systematic and system specific instrument errors; the velocity of sound in water; static vessel draft; dynamic vessel draft; heave, roll, and pitch; and any other sources of error in the actual measurement process, including the errors associated with water level (tide) variations (both tidal measurement and zoning errors).

Lineage:

Process_Step:

Process_Description:

The Multibeam sonar system is maintained and operated from data acquisition to processing, such that it detects shoals that measure 2 meters x 2 meters horizontally and 1 meter vertically in depths of 40 meters or less. For depths greater than 40 meters, the minimum size of detectable targets is 10 percent of the depth for horizontal dimensions and 5 percent of the depth for vertical dimensions. Depths are determined and recorded with a vertical resolution no coarser than 10 centimeters. The vessel speeds are maintained so that no less than 3.2 beam footprints, center-to-center, fall within 3 meters or a distance equal to 10 percent of the depth, whichever was greater, in the along track direction.

Total swath widths are no less than twice the water depth. The portions of the swath widths greater than twice the water depth that do not meet these resolution requirements and the accuracy requirements are not depicted on the preliminary smooth sheet or included in the digital file for the preliminary smooth sheet.

Sounding tracklines are generally parallel to each other. Sinuous lines and data acquired during turns are not included in the final processed data, and are not used to meet coverage requirements.

To meet the accuracy and resolution standards for measured depths specified in the NOS Hydrographic Surveys, Specifications and Deliverables, measured echosounder depths were corrected for all departures from true depths attributable to the method of sounding or to faults in the measuring apparatus.

These correction are subdivided into five categories, and are listed below in the

sequence in which they were applied to the data.

Instrument error corrections: account for sources of error related to the sounding equipment itself.

Draft corrections: were added to the observed sounding to account for the depth of the echosounder transducer below the water surface.

Appropriate correction for settlement and squat: were applied to soundings to correct the vertical displacement of the transducer, relative to its position at rest, when a vessel is underway.

Velocity of sound correctors: were applied to soundings to compensate for the fact that echosounders may only display depths based on an assumed sound velocity profile while the true velocity my vary in time and space.

Heave, roll, pitch, heading, and navigation timing error corrections: were applied to Multibeam soundings to correct the effect of vessel motion caused by waves and swells, the error in the vessel's heading, and the time delay from the moment the position is measured until the data is received by the data collection system.

Process_Date: Unknown
Process_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Coast Survey (OCS), Hydrographic Surveys Division (HSD)
Contact_Position: Chief, Hydrographic Surveys Division
Contact_Address:
Address_Type: mailing and physical
Address: 1315 East West Highway N/CS3
City: Silver Spring
State_or_Province: MD
Postal_Code: 20910
Contact_Voice_Telephone: 301-713-2700
Contact_Electronic_Mail_Address: HSD.Inquiries@noaa.gov
Process_Step:
Process_Description:
Side Scan Sonar may be required for supplementing echo-sounding by searching the region between regular sounding lines for additional indications of dangers and topographic irregularities.

The side scan sonar system is operated in such a manner that it is capable of detecting an object on the sea floor that measures 1 m x 1 m x 1 m from shadow length measurements.

Confidence checks on the side scan sonar system are conducted daily to

identify the location of known features.

Process_Date: unknown
Process_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Coast Survey (OCS), Hydrographic Surveys Division (HSD)
Contact_Position: Chief, Hydrographic Surveys Division
Contact_Address:
Address_Type: mailing and physical
Address: 1315 East West Highway N/CS3
City: Silver Spring
State_or_Province: MD
Postal_Code: 20910
Contact_Voice_Telephone: 301-713-2700
Contact_Electronic_Mail_Address: HSD.Inquiries@noaa.gov
Process_Step:
Process_Description:
Tides and water level data are gathered during a hydrographic survey to establish a time series of water level reducers that can be applied to hydrographic soundings, so that they can be corrected to chart datum. From stations in continuous operation (by the Center for Operational Oceanographic Products and Services(CO-OPS)) data acquisition is required from 4 hours before to 4 hours after the period of hydrography, and/or shoreline verification in a given area is completed. If subordinate tidal stations are installed to establish tidal datum and tide reducers for a given region, the station must be in continuous operation for not less than 30 days.
Process_Date: unknown
Process_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Coast Survey (OCS), Hydrographic Surveys Division (HSD)
Contact_Position: Chief, Hydrographic Surveys Division
Contact_Address:
Address_Type: mailing and physical
Address: 1315 East West Highway N/CS3
City: Silver Spring
State_or_Province: MD
Postal_Code: 20910
Contact_Voice_Telephone: 301-713-2700
Contact_Electronic_Mail_Address: HSD.Inquiries@noaa.gov
Process_Step:
Process_Description: Metadata imported.
Source_Used_Citation_Abbreviation: C:\DOCUME~1\RACHEL~1.ISA\LOCALS~1\Temp\xml13.tmp

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Geographic:
Latitude_Resolution: 0.0000001
Longitude_Resolution: 0.0000001
Geographic_Coordinate_Units: decimal degrees
Geodetic_Model:
Horizontal_Datum_Name: NAD 83
Ellipsoid_Name: WGS84
Semi-major_Axis: 6378137
Denominator_of_Flattening_Ratio: 298.257223563
Vertical_Coordinate_System_Definition:
Depth_System_Definition:
Depth_Datum_Name: Mean Lower Low Water
Depth_Resolution: 0.1
Depth_Distance_Units: meters
Depth_Encoding_Method: Explicit depth coordinate included with horizontal coordinates

---

Distribution_Information:
Distributor:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Coast Survey (OCS), Hydrographic Surveys Division (HSD)
Contact_Position: Chief, Hydrographic Surveys Division
Contact_Address:
Address_Type: mailing and physical
Address: 1315 East West Highway N/CS3
City: Silver Spring
State_or_Province: MD
Postal_Code: 20910
Contact_Voice_Telephone: 301-713-2710
Contact_Electronic_Mail_Address: HSD.Inquiries@noaa.gov
Resource_Description: Downloadable data
Distribution_Liability:
THESE DATA ARE NOT FOR NAVIGATIONAL USE. These data have been used by the National Oceanic and Atmospheric Administration (NOAA). There is no warranty expressed or implied as to the accuracy of the data made by NOAA. NOAA assumes no liability for uses of these data. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by NOAA in the use of this data, software, or related materials.

Please recognize NOAA as the source of this information.

Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name: ASCII
Digital_Transfer_Option:
Online_Option:
Computer_Contact_Information:
Network_Address:
Network_Resource_Name:
<http://chartmaker.ncd.noaa.gov/hsd/hsd-2.html>
Offline_Option:
Offline_Media: CD-ROM
Recording_Format: ISO 9660
Fees: Varies

Metadata_Reference_Information:
Metadata_Date: 20030227
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Office of Coast Survey (OCS), Hydrographic Surveys Division (HSD)
Contact_Person: REQUIRED: The person responsible for the metadata information.
Contact_Position: Chief, Hydrographic Surveys Division
Contact_Address:
Address_Type: mailing and physical
Address: 1315 East West Highway N/CS3
City: Silver Spring
State_or_Province: MD
Postal_Code: 20910
Contact_Voice_Telephone: 301-713-2700
Contact_Electronic_Mail_Address: HSD.Inquiries@noaa.gov
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998
Metadata_Time_Convention: local time
Metadata_Extensions:
Metadata_Extensions:
Online_Linkage: <http://www.esri.com/metadata/esriprof80.html>
Profile_Name: ESRI Metadata Profile
